

Technological Change in the Field of Payment Instruments – Long-Term Implications for Monetary Policy and Competition Policy

Helmut Stix,
Martin Summer¹

In July 2010 the Oesterreichische Nationalbank hosted a workshop entitled “Consumer Payment Choice and the Demand for Money,” which provided insights into state-of-the-art research on payment habits and cash demand. The papers presented showed that there is a vast potential for new research in this field – in particular, when new theoretical approaches are combined with newly available micro data on household payment habits. This holds the promise of uncovering interesting new findings on the implications of technological change in the field of payment instruments for monetary and competition policies. Thus, it is of substantial importance for central banks to participate in such research activities.

Will cash be obsolete in the long term? Are new electronic payment technologies affecting the velocity of money demand and interest rate elasticity, and thus the monetary transmission mechanism? From a social perspective, does it make sense to use up to ten different network technologies for processing payments?

At first sight, such questions sound academic and more of a theoretical interest. However, this perception is misleading. After all, the past two decades have seen tremendous technological advances in the area of point-of-sale payments, and the dynamics of change continue to be very high. What is important for central banks in this respect is that the long-term evolution of cash usage, given the diffusion of new means of payment, is having implications both for the transmission mechanism of monetary policy and for one central activity of central banks – the provision of cash. Although the impact of the proliferation of new payment means in these areas is immediate and tangible, theoretical and empirical evidence on the implications of this development is still limited, notwithstanding the fact that researchers started to

look into the microeconomic structure of payment and cash holding habits of households and businesses as early as in the 1950s in order to better understand the hypotheses formulated on aggregate demand for money, as used in macroeconomic models of both the Keynesian and the monetarist type. Subsequent research has underlined the importance of such insights, as the assessment of the welfare costs of inflation is highly dependent on the exact microeconomic patterns of payment habits. Moreover, payment innovations have also given rise to substantial regulatory and competition problems.

The Economic Studies Division of the Oesterreichische Nationalbank (OeNB) has a long-standing research focus on technological advances in the field of payment instruments. Specifically, it has conducted and published regular surveys on payment habits since the 1990s, and it has been using the survey data for research purposes for a couple of years. Against this backdrop, the Economic Studies Division joined forces with experts of the Deutsche Bundesbank and two leading academic researchers in the field, namely Fernando Alvarez (University of Chicago) and

¹ Oesterreichische Nationalbank, Economic Studies Division, helmut.stix@oenb.at, martin.summer@oenb.at

Francesco Lippi (University of Sassari and Einaudi Institute for Economics and Finance), and hosted a research workshop which took place on July 1 and 2, 2010, at the OeNB. The aim of the workshop was to bring together researchers who work on this topic, to discuss the state of research and to disseminate new ideas and modeling approaches. Participants came from the Federal Reserve Bank of Boston, the Bank of Canada, the ECB, De Nederlandsche Bank, the Deutsche Bundesbank, Banca d'Italia, the Banque de France, the Bank of Finland, Norges Bank, Česká národní banka as well as from the University of Chicago, the University of Haifa, the Universidade Nova de Lisboa, the London School of Economics, the École Nationale Supérieure des Télécommunications, the University of Sassari, Indiana University, the University of Vienna, and the Vienna Institute for Advanced Studies.

Essentially, the two-day workshop was designed to look into three different areas in which research has been particularly prolific as of late: During the first session of day one, *Scott Schuh (Federal Reserve Bank of Boston)* and *Carlos Arango (Bank of Canada)* presented new broad-based surveys on payment habits and empirical results based on these surveys. The second session of day one featured presentations by *Wilko Bolt (De Nederlandsche Bank)*, *Tobias Schmidt (Deutsche Bundesbank)* and *David Bounie (École Nationale Supérieure des Télécommunications)*, which were dedicated to theoretical or microeconomic models of payment habits. Day two brought presentations on the macroeconomic implications of the microeconomics of payment habits by *Fernando Alvarez (University of Chicago)*, *Andre Silva (Universidade Nova de Lisboa)* and *Xavier Ragot (Banque de France and Paris School of Economics)*.

Cash or Card? Surveys and Empirical Evidence

The degree to which consumers will continue to pay cash is an issue that is close to the heart of central banks. After all, central banks are responsible for the production and circulation of cash, and they need information on people's payment habits to be able to manage logistics adequately. Beyond the narrow operational focus, the long-term significance of cash is also relevant for more fundamental macroeconomic issues, such as: How is the transmission mechanism of monetary policy changing in a world in which cash is becoming less and less important? How do these developments affect our understanding and our assessment of inflation dynamics and the welfare costs of inflation?

Given the strategic significance and the economic policy implications of these issues, it is no coincidence that central banks worldwide are intensifying their efforts to develop data sets that will allow them to improve our understanding of these issues. With its payment habit surveys, the OeNB has done early work in this respect. A representative of a central bank with an established (and growing) research record in the field and a representative of a central bank which developed a national survey more recently opened the workshop on which we report here.

Scott Schuh (Federal Reserve Bank of Boston) provided a rundown of the survey-based research conducted by his institution in the more recent past. What started with a more narrow research interest in compiling data on the use of payment instruments (for instance with a view to assessing the future of check payments, which are very popular in the U.S.A.) has over time developed into one of the largest and most systematic payment surveys worldwide. In the

study *How Consumers Pay: Modeling Adoption and Use of Payment Instruments*, the data compiled were used for a microeconomic analysis of the factors that drive the decision to adopt and to use different payment instruments. A key finding of this study was that, while transactions costs of course play an important role, the choice of one payment instrument over another also depends on the characteristics of the payment instruments at hand.

Carlos Arango (Bank of Canada) presented initial results of a household survey launched by his institution in 2009, focusing on the underlying methodology, on the scope of the survey as well as on plans for future research. Given the rather unique scope of the information compiled, the survey data provide a very detailed overview of the payment and cash-withdrawing habits of the Canadian population. Methodologically speaking, both presentations showed how valuable the information is that can be compiled with state-of-the-art surveys. Looking ahead, we can expect further research in this particular area and further insights from those activities. Last but not least, the two presentations provided an excellent overview of developments on the other side of the Atlantic, thus facilitating a comparison with the situation in various European countries. *Kim Huynh (Indiana University and Bank of Canada)* as well as *Nicole Jonker (De Nederlandsche Bank)* provided comments on the two presentations.

Modeling Payment Habits – Implications for the Demand for Cash

The latter part of day one dealt with different approaches to modeling payment habits. *Wilko Bolt (De Nederlandsche Bank)* presented a theoretical microeconomic model, whereas *Tobias*

Schmidt (Deutsche Bundesbank) and *David Bounie (École Nationale Supérieure des Télécommunications)* presented empirical evidence based on microeconomic models.

The paper by *Wilko Bolt*, co-authored with *Sujit Chakravorti (Federal Reserve Bank of Chicago)* and entitled *Consumer Choice and Merchant Acceptance of Payment Media*, analyzes the prevalence of different payment instruments and their respective pricing structures in the form of a static model. In this model, three groups of agents – consumers, retailers and banks – each choose a payment instrument, a payment system network and a payment service. Using equilibrium analysis, the authors aim to explain the adoption rate of a given payment instrument (such as the percentage of retailers who accept debit card payments), the fee structure of this instrument and its allocative efficiency. Such a theoretical perspective makes sense, as it facilitates a systematic assessment of the adoption patterns of different payment instruments and as it provides insights into the pricing of payment services fees, which is relevant for regulatory policy-making. A key finding of this analysis is that equilibrium fee structures lack efficiency, which according to the authors highlights the need for regulatory action.

The discussant of the paper, *Francesco Lippi (University of Sassari and Einaudi Institute for Economics and Finance)*, while underlining the significance of the issue at hand, critically discussed some details of the model, in particular the result that retailers accept various payment instruments in equilibrium. Lippi maintained that the simultaneity of payment instruments is only inadequately explained by the model.

Tobias Schmidt (Deutsche Bundesbank) presented a joint paper with *Ulf von*

Kalckreuth (Deutsche Bundesbank) and *Helmut Stix (OeNB)*. The purpose of the paper entitled *Using Cash to Monitor Expenditures – Implications for Payments, Currency Demand and Withdrawal Behaviour* is to model consumers' cash holding habits. The starting point of their work is that cash has a comparative advantage over other payment instruments when it comes to keeping track of one's expenses. This is why some consumers prefer to pay cash even when they could make cashless payments. The authors test and confirm this behavioral hypothesis in a micro-econometric analysis of Austrian and German survey data. Apart from several empirical insights, the key finding of the paper is the implication that cash is unlikely to be crowded out completely by payment innovations – which is in line with the fact that cash continues to be rather important despite the widespread use of new payment instruments, such as credit or debit cards.

The paper was discussed by *David Bounie (École Nationale Supérieure des Télécommunications)*, who focused on the technical aspects of the econometric analysis and cross-checked the underlying hypothesis by applying it to a comparable French micro data set. While the sustained importance of cash became evident also from the French data, Bounie called into question the hypothesis that cash has a comparative advantage over other payment instruments when it comes to tracking one's expenses.

David Bounie moved on to present a paper of his own, entitled *Debit Card and the Demand for Cash* and co-authored with *Abel François (École Nationale Supérieure des Télécommunications)*. Their paper, also a micro-econometric study, discussed the long-term significance of cash in France. The authors found that ATM withdrawals increased the preva-

lence of cash transactions, whereas debit card payments decreased them. Aggregating both effects showed that, on balance, debit cards significantly reduced the prevalence of cash.

The discussant, *Alessandro Secchi (Banca d'Italia)*, highlighted some incongruities between the theoretical results of the model and the empirical results of the estimates, but found the paper as such to be significant and relevant.

The papers presented in the second session all concluded that cash was rather unlikely to rapidly lose in importance or to be crowded out altogether despite the high incidence of payment innovations. This insight has been confirmed by both theoretical and empirical results, which contain valuable information for central banks in terms of their strategic and policy implications.

Payment Habits, Cash Demand and Inflation Costs

The second workshop day focused on macro-econometric findings on payment habits and payment innovations, with *Fernando Alvarez (University of Chicago)*, *Andre Silva (Universidade Nova de Lisboa)* and *Xavier Ragot (Banque de France and Paris School of Economics)* discussing the issues from different perspectives.

Fernando Alvarez opened day two with a presentation of a joint paper with *Francesco Lippi* entitled *The Demand for Currency with Uncertain Lumpy Purchases*. Since Baumol and Tobin's models of cash management in the 1950s, inventory-theoretic models have played a central role in the microeconomic literature on money demand. Thanks to the availability of detailed survey data, the traditional research approach of using cash management models to provide microfoundations for the

aggregate money demand function can now be developed more fundamentally in line with empirical facts. In the paper, this approach is applied to several special cases for which it is possible to provide explicit solutions and identify the model based on the available survey data. Specifically, Alvarez and Lippi develop an inventory model with occasional large purchases that must be paid in cash. While the average level of cash balances remains unchanged in such a scenario, the average size of cash withdrawals is found to change. Moreover, the model implies that agents typically hold precautionary balances at the time of withdrawals. This helps explain deviations from the Baumol-Tobin model found in the data. In addition to explaining the consumer perspective, this approach may also be used to explain corporate demand for liquid assets.

The discussant of the paper, Avner Bar-ilan (*University of Haifa*), welcomed the empirical substantiation of cash management models and the analysis of their macroeconomic implications. The preliminary aspects of the work and the new modeling approach gave rise to a discussion on various technical details. The tenor of the discussion was that lending empirical support to currency demand models is a worthwhile research program, as it is capable of bridging the gap between microeconomic structures of cash holdings and macroeconomic cash demand parameters, which will ultimately deepen our understanding of the transmission mechanism and of the welfare costs of inflation.

Next, Andre Silva (*Universidade Nova de Lisboa*) discussed inflation costs in a model in which agents determine the frequency at which they exchange bonds for money – i.e. they make a choice of payment instruments. The

key finding of his paper – entitled *Rebalancing Frequency and the Welfare Cost of Inflation* – is that the endogeneity of the frequency of transactions, in contrast to transacting at fixed intervals, leads to high welfare costs of inflation: As inflation rises, cash-holding levels need to be adjusted more frequently, which in turn pushes up welfare costs. The author estimates an inflation rate of 10% to cost a U.S. household some USD 900 per year on average.

The discussant, Michael Reiter (*Vienna Institute for Advanced Studies*), underlined the significance of this result but at the same time questioned the calibration of the model as it showed welfare costs to be that high. He criticized that the work provided little evidence – beyond the evidence used for calibrating the model – on the relationship between the frequency of transactions and inflation levels.

The final paper on the workshop agenda was *The Case for a Financial Approach to Money Demand* by Xavier Ragot (*Banque de France and Paris School of Economics*). The starting point for his study was that the traditional monetary models of macroeconomic theory imply that the distribution of money is directly linked to the distribution of consumption. Yet the data show that the distribution of money is much more similar to the distribution of financial assets and rather dissimilar to that of consumption. Ragot argued that a model with frictions in both the financial and the goods markets is much better suited to reproduce a realistic joint distribution of consumption, money and financial assets. The friction in the financial market is a fixed cost to adjust the financial portfolio, which creates a financial motive to hold money. Given that, he considered the empirical relevance of a macroeconomic theory of

money demand to be fundamentally dependent on the underlying theories on payment instruments.

The discussant, *Philipp Schmidt-Dengler (London School of Economics)*, found the approach of the paper to be convincing, apart from the fact that the paper did not go beyond the stage of a thought experiment. He maintained that the paper failed to address the factors that cause the observed distributions and that it lacked elements that would have allowed for an external validation of the model. Yet like the other presentations of the day, this paper, too, highlighted the potential that research on payment instruments has for enhancing and deepening our understanding of macroeconomic monetary issues.

The Significance of Research on Payment Instruments – A Bird’s Eye View

Overall, the workshop on *Consumer Payment Choice and the Demand for Money* provided an excellent overview on the state of the research in the field. While a couple of years ago, just a handful of central banks, including the OeNB, had had a payment systems research agenda, international interest in the issue has since increased, and a number of eminent mainstream academic researchers have started to tackle it as well. Can central banks afford not to do research in this field? Is this field relevant? Can it be developed further? Does it have the potential to attract more academic researchers?

The findings of the workshop provided answers to those questions, namely that, for one, it is indeed of substantial importance for central banks to look into those issues. The choice of payment instruments and the factors

that determine this choice are of central strategic importance; after all, how we pay and why we do so also has direct implications for our understanding of the demand for currency and of the transmission mechanism. Thus, the issue of payment instruments touches upon a core competence of central banks.

The workshop presentations show that the research can be developed further. While still in its infancy, survey-based research projects are already providing highly useful data, which holds the promise that this strand of research will deepen and enhance our understanding of the underlying issues. The data might moreover help establish an empirically more robust basis for the discussion on regulatory aspects of payment innovations. There is also a distinct possibility that more academic researchers might take an interest in the issues. Finally, there is still a big divide between microeconomic and macroeconomic models. While providing microfoundations for macroeconomics has come under much criticism in recent years and has thus been discarded by many economists, research on the microstructure of payments is an area in which it makes sense to pursue further the concept of developing a meaningful combination of microeconomic and macroeconomic approaches. There is a clear link between the relevant concepts and the available micro data, and it would appear that all that remains to be done is to connect the dots. The OeNB’s workshop showed that some important steps have already been taken in this direction, and that *Consumer Payment Choice and the Demand for Money* is a research agenda with a short past and a promising present and future.

